CLAIMS

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1. A liquid crystal device comprising:

a first substrate formed with a plurality of pixels, each having a pixel electrode formed thereon;

a second substrate opposing the first substrate; and

liquid crystal sandwiched between the first substrate and the second substrate,

wherein the first substrate and the second substrate are constructed so as to emit, of light incident from one substrate, light incident from a clear viewing direction in a larger amount than light incident from opposite of the clear viewing direction.

2. The liquid crystal device according to claim 1, wherein the one substrate is formed with a light-shielding film in a matrix so as to overlap an area corresponding to an area between adjacent pixel electrodes.

3. The liquid crystal device according to claim 1 or 2, wherein the first substrate and the second substrate are formed with a first opening area and a second opening area for each pixel, and

wherein, of the first opening area and the second opening area, a center position of the opening area formed in the one substrate is offset toward the clear viewing direction with respect to a center position of the opening area formed in another substrate from which light is emitted.

4. The liquid crystal device according to claim 3, wherein the one substrate is formed with a microlens so as to oppose each pixel, and

wherein an optical center position of the microlens is arranged so as to substantially coincide with the center position of the opening area of the one substrate.

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5. The liquid crystal device according to any one of claims 1 to 4, wherein the one substrate is formed with a microlens so as to oppose each pixel, and

wherein an optical center position of the microlens is offset toward the clear viewing direction with respect to a center position of an opening area of another substrate of the first substrate and the second substrate from which light is emitted.

6. The liquid crystal device according to claim 5, wherein, of the first substrate and the second substrate, the other substrate from which light is emitted is formed with a microlens so as to oppose each pixel.

7. The liquid crystal device according to claim 6, wherein an optical center position of the microlens formed on the other substrate is offset toward the clear viewing direction with respect to a center position of the opening area of the one substrate.

8. The liquid crystal device according to any one of claims 3 to 7, wherein the first substrate and the second substrate are formed with a first light-shielding film and a second light-shielding film formed in a matrix, respectively, so as to overlap an area corresponding to an area between adjacent pixel electrodes, whereby the first opening area and the second opening area are partitioned and formed in a matrix for each pixel by the first light-shielding film and the second light-shielding film.

9. The liquid crystal device according to claim 8, wherein, of the first light-shielding film and the second light-shielding film, the light-shielding film formed on the one substrate broadly overlaps the opening area formed in the other substrate at a side opposite the clear viewing direction compared to a side of the clear viewing direction, whereby, of the first opening area and the second opening area, a center position of the opening area formed in the one substrate is offset toward the clear viewing direction with respect to the center position of the opening area formed in the other substrate.

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10. The liquid crystal device according to claim 8, of the first light-shielding film and the second light-shielding film, the light-shielding film formed on the other substrate broadly overlaps the opening area formed in the one substrate at the side of the clear viewing direction compared to the side opposite the clear viewing direction, whereby, of the first opening area and the second opening area, the center position of the opening area formed in the one substrate is offset toward the clear viewing direction with respect to the center position of the opening area formed in the other substrate.

11. The liquid crystal device according to claim 1 or 2, wherein an asymmetric microlens, for emitting a larger amount of light incident on the one substrate from the clear viewing direction to the liquid crystal than an amount of light incident on the one substrate from opposite the clear viewing direction, is formed in an area of the one substrate opposing each pixel.

12. The liquid crystal device according to claim 1 or 2, wherein, of a high-refractive index layer formed on a side of a light incident surface of the one substrate and a low-refractive index layer formed on a side of a light emitting surface of the one substrate, a microlens such that the low-refractive index layer is increased in thickness from a center of the pixel toward the clear viewing direction and is reduced in thickness toward the opposite of the clear viewing direction, is formed in an area of the one substrate opposing each pixel.

13. The liquid crystal device according to claim 1 or 2, wherein, of a low-refractive index layer formed on a light incident-side of the one substrate and a high-refractive index layer formed on a light emitting-side of the one substrate, a microlens such that the high-refractive index layer is reduced in thickness from a center of the pixel toward the clear viewing direction and is increased in thickness toward the opposite of the clear viewing direction, is formed in an area of the one substrate opposing each pixel.

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14. The liquid crystal device according to claim 1 or 2, wherein, of a medium-refractive index layer formed on a light incident-side of the one substrate, a low-refractive index layer formed at a side of the clear viewing direction on a light emitting-side of the substrate, and a high-refractive index layer adjacent to the low-reflective index layer at the side opposite the clear viewing direction on the light emitting-side of the substrate, a microlens such that the low-refractive index layer and the high-refractive index layer are increased in thickness from a center of the pixel toward the clear viewing direction and the opposite of the clear viewing direction, respectively, is formed in an area of the one substrate opposing each pixel.

15. The liquid crystal device according to claim 1 or 2, wherein, of a medium-refractive index layer formed on a light incident-side of the one substrate, a high-refractive index layer formed at a side of the clear viewing direction on a light emitting-side of the substrate, and a low-refractive index layer adjacent to the high-reflective index layer at a side opposite the clear viewing direction on the light emitting-side of the substrate, a microlens such that the high-refractive index layer and the low-refractive index layer are reduced in thickness from a center of the pixel toward the clear viewing direction and the opposite of the clear viewing direction, respectively, is formed in each area of the one substrate opposing each of the plurality of pixels.

16. The liquid crystal device according to any one of claims 11 to 15, wherein a non-lens area for allowing light perpendicularly incident on the one substrate to travel in a straight line toward the liquid crystal is formed on a center of the pixel in the microlens.

17. The liquid crystal device according to claim 16, wherein the one substrate includes a microlens substrate formed with the microlens, and a thin plate bonded to the microlens substrate via a bonding agent,

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wherein the microlens has a convex shape having a flat surface for forming the non-lens area in the center of the pixel, and

wherein the microlens substrate and the thin plate are bonded with the thin plate abutted against the flat surface.

18. The liquid crystal device according to any one of claims 1 to 17, wherein the first substrate is formed with a plurality of scanning lines and a plurality of data lines, the scanning lines and the data lines are connected to a pixel switching element, and the pixel switching element is connected to the pixel electrode.

19. The liquid crystal device according to any one of claims 1 to 18, wherein the one substrate is the second substrate.

20. The liquid crystal device according to claim 19, wherein the first substrate is formed with a plurality of scanning lines and a plurality of data lines, and the pixel electrode is connected to the scanning lines and the data lines via a pixel switching element, and

wherein the pixel switching element is formed on a side of the clear viewing direction in the pixel with respect to the pixel electrode.

21. The liquid crystal device according to claim 19, wherein, in each pixel, each of the scanning lines corresponding to the pixel, and a capacitor line for forming a storage capacitor, are formed on the side of the clear viewing direction.

22. The projection display device using the liquid crystal device defined by any one of claims 1 to 21, characterized by comprising:

a light source;

a condenser optical system for guiding light emitted from the light source to the liquid crystal; and

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an enlarging and projecting optical system for enlarging and projecting the light modulated by the liquid crystal device.

23. The projection display device according to claim 22, wherein an optical axis of light incident on the liquid crystal device is inclined toward the clear viewing direction with respect to a normal line direction of the liquid crystal device.

24. The projection display device according to claim 23, wherein the liquid crystal device is arranged in an oblique position to incline the optical axis of the light incident on the liquid crystal toward the clear viewing direction with respect to the normal line direction of the liquid crystal device.

25. The projection display device according to claim 23 or 24, wherein a condenser lens used in the condenser optical system is arranged in an oblique position to incline the optical axis of the light incident on the liquid crystal toward the clear viewing direction with respect to the normal line direction of the liquid crystal device.

26. The projection display device according to any one of claims 23 to 25, wherein a reflecting mirror used in the condenser optical system is arranged in an oblique position to incline the optical axis of the light incident on the liquid crystal toward the clear viewing direction with respect to the normal line direction of the liquid crystal device.

27. The projection display device according to any one of claims 23 to 24, wherein a plurality of liquid crystal devices are used, and an angle of the optical axis of the incident light inclined with respect to the normal line direction of a liquid crystal device is set to a predetermined value for each of the plurality of liquid crystal devices.

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